

# Hydroinformatik I - WiSe 2019/2020

## V1: Einführung

Prof. Dr.-Ing. habil. Olaf Kolditz

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<sup>2</sup>Technische Universität Dresden – TUD, Dresden

<sup>3</sup>Center for Advanced Water Research – CAWR

Dresden, 18.10.2019

# Fahrplan für heute ...

1. Vorstellung
2. Organisatorisches
3. Einführung in die Hydrosystemanalyse / Hydroinformatik
4. Handwerkzeug: Compiler, IDEs, ... (HW1)
5. Ihre Fragen

# Vorstellung (CV)

## Studies and Qualifications

- ▶ Studium Ukraine (Physik)
- ▶ Promotion AdW Chemnitz (Hydromechanik)
- ▶ Habil U Hannover (Geohydrologie)
- ▶ Auslandsaufenthalte (USA, CA, JP)

## Professional Career

- ▶ Oberassistent U Hannover (Hydromechanik)
- ▶ Prof. U Tübingen (Hydroinformatik)
- ▶ Prof. TU Dresden (Systemanalyse)
- ▶ Department Umweltinformatik UFZ Leipzig

## Community Activities/Services

- ▶ OpenGeoSys initiative ([www.opengeosys.org](http://www.opengeosys.org))
- ▶ EiC "Environmental Earth Sciences", "Geothermal Energy"
- ▶ Think Tank HIGRADE Graduate PhD School

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# Organisatorisches

- ▶ Lehre Website: 'Googlen' "Hydroinformatik"  
<http://www.ufz.de/index.php?de=40416>
- ▶ Vorlesungsskript (Literatur)
- ▶ Vorlesungen
- ▶ Übungen
- ▶ Zeitplan für das Semester (Vertretungen)
- ▶ Sprechstunde
- ▶ Klausur
- ▶ Rechner
- ▶ Mobiltelefon: 0151 52739034 (für Notfälle)

# Vorlesungsplan

WiSe 2019/2020: Hydroinformatik I, Freitag (3. DS) 11:10-12:40, HÜL/S186/H					
No	KW	Datum	ID	Vorlesung	Dozent
1a	42	19.10.2019	BHYWI-08-01	Hydroinformatik - Einführung	Kolditz
1b	42	19.10.2019	BHYWI-08-02	Compiler (Installation)	Kolditz
2	43	25.10.2019	BHYWI-08-03	Datentypen	Kolditz
3	44	01.11.2019	BHYWI-08-05	Hausaufgaben	Kolditz
5	45	08.11.2019	BHYWI-08-04	Einführung in Python	Kolditz
4	46	15.11.2019	BHYWI-08-06	Programmieren in Nat-Ing	Kalbacher
6	47	22.11.2019	BHYWI-08-07	Klassen	Kolditz
7	48	29.11.2019	BHYWI-08-08	Input-Output (I/O)	Kolditz
8	49	06.12.2019	BHYWI-08-09	Strings - Textverarbeitung	NN
9	50	13.12.2019	BHYWI-08-10	Pointer	NN
10	51	20.12.2019	BHYWI-08-11	Container	Kolditz
11	1	03.01.2020	BHYWI-08-12	BigData & Water 4.0	Kolditz
12	2	10.01.2020	BHYWI-08-13	Hydrologische Modellierung	Kolditz
13	3	17.01.2020	BHYWI-08-14	Neuronale Netzwerke	Kolditz
14	4	24.01.2020	BHYWI-08-15	ANN / Bayes'sche Netzwerke	Kolditz
15	5	31.01.2020	BHYWI-08-16	BN / Maschinelles Lernen	Kolditz
16	6	07.02.2020	BHYWI-08-17	Klausurvorbereitung	Kolditz



Lehre Webseite:

<http://www.ufz.de/index.php?de=40416>

HELMHOLTZ ZENTRUM FÜR UMWELTFORSCHUNG UFZ

Impressum Datenschutz Direktlinks DE Suche

Das UFZ Themenbereiche / Departments Forschung Medien/Presse Veranstaltungen Karriere/Jobs

Themenbereiche / Departments > Smarte Modelle und Monitoring > Umweltinformatik > Lehre > Hydroinformatik I

Ökosysteme der Zukunft  
Wasserressourcen und Umwelt  
Chemikalien in der Umwelt  
Umwelt- und Biotechnologie  
Smarte Modelle und Monitoring  
Hydrosystemmodellierung  
Monitoring- und Erkundungstechnologien  
Ökologische Systemanalyse  
Remote Sensing  
Umweltinformatik  
Arbeitsgruppen  
Projekte  
Team  
Publikationen  
Lehre  
Hydroinformatik I  
Hydroinformatik II  
Hydrosystemanalyse

Professur für Angewandte Umweltsystemanalyse an der TU Dresden

Hydroinformatik I (BHYWI 08)

Vorlesungen: 3. DS (11.10-12.40) HÜLS186/H  
Sprechstunde: Freitags, 10.00 - 11.00 Uhr  
Neubau Chemie 2, Bauabschnitt, CHE-BA2, Room P204  
Nottal-Mobile: 0151 52739034  
Klausur: 08.02.2018, 09.20-10.50 Uhr, POT/81/H

Wintersemester 2018/2019

Lehrveranstaltungen

12.10.2018: 1 Vorlesung: Einführung in die Veranstaltung (1 MB)

No	Datum	Vorlesung	Übung	Dozent
1	12.10.2018	Hydroinformatik - Einführung		Kolditz
2	19.10.2018	Compiler installation / Datentypen	Hello World	Rink
3	26.10.2018	Programmieren in Nat-Ing		Kalbacher
4	02.11.2018	Klassen	class	Kolditz

**Kontakt**  
Sekretariat:  
Catharina Reul  
Telefon: +49 341 235-1281  
catharina.reul-jmenez@ufz.de  
Sindy Bieholder  
Telefon: +49 341 235-1250  
sindy.bieholder@ufz.de  
OpenGeoSys:  
info@opengeosys.org  
User Mailing-Liste

News / Presse  
OpenGeoSys.org now live!

Neue Bücher

# Bücher über Bücher ... online Kurse



C++ - Lernen und professionell anwenden von Ulla Kirch-Prinz und Peter Prinz

Die C++-Programmiersprache. Deutsche Übersetzung der Special Edition von Bjarne Stroustrup

C/C++ Kompendium: Das komplette Programmierwissen für Studium und Job von Dirk Louis



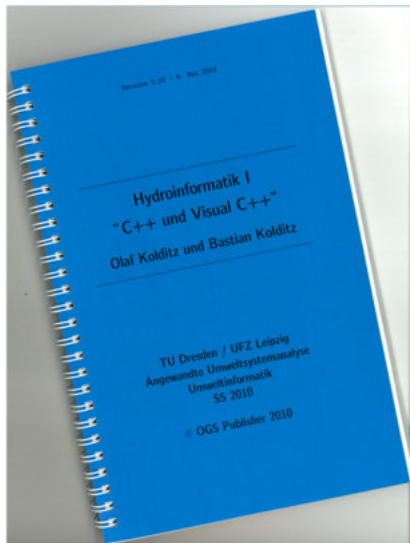
Einstieg in Visual C++ 2008 von André Willms

C/C++: Von den Grundlagen zur professionellen Programmierung von Ulrich Kaiser und Christoph Kecher

C++ für Spieleprogrammierer von Heiko Kalista



# Skript

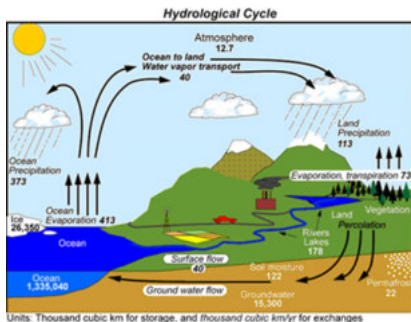


Online-Kurs:  
[www.learncpp.com](http://www.learncpp.com)

# Hydrosystemanalyse (Hydroinformatik)

# Hydrosysteme

## Wasserkreislauf



Referenz: Sachse et al. (2014) OGS Tutorial  
"Computational Hydrology"

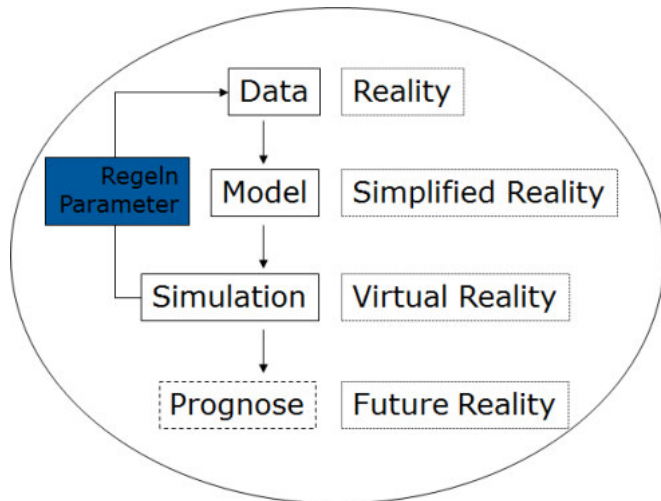
## Totes Meer (Dead Sea) - Arid



## Elbe - Humid

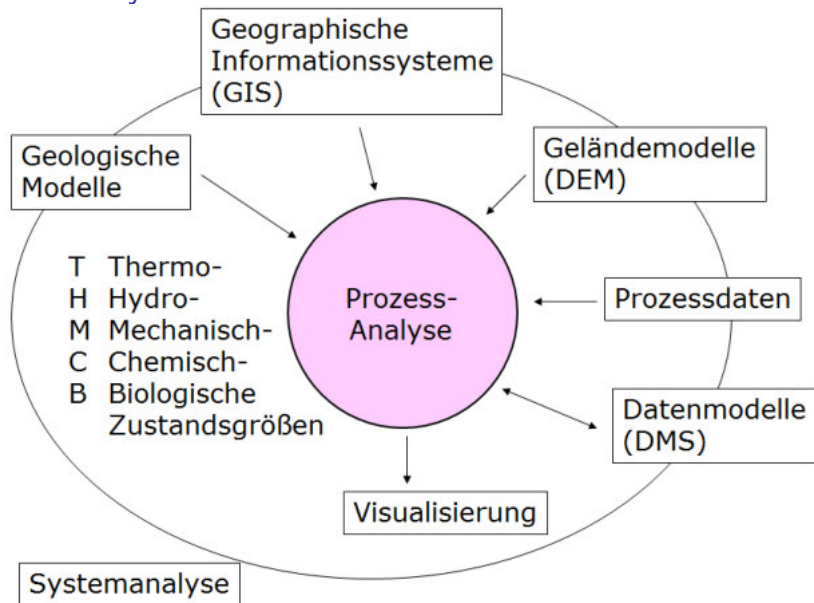


# Systemanalyse

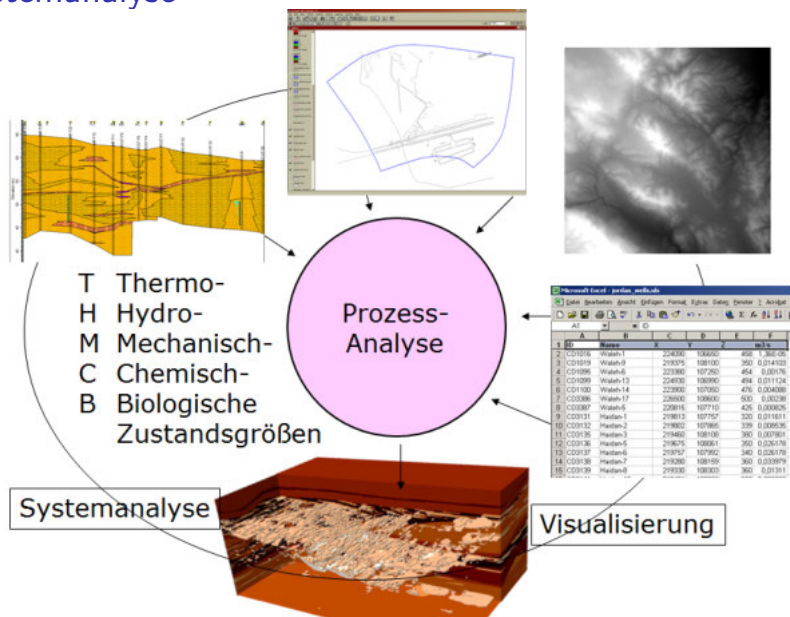


↔ Kalibrierung → Verifizierung → Validierung ↔

# Systemanalyse



# Systemanalyse





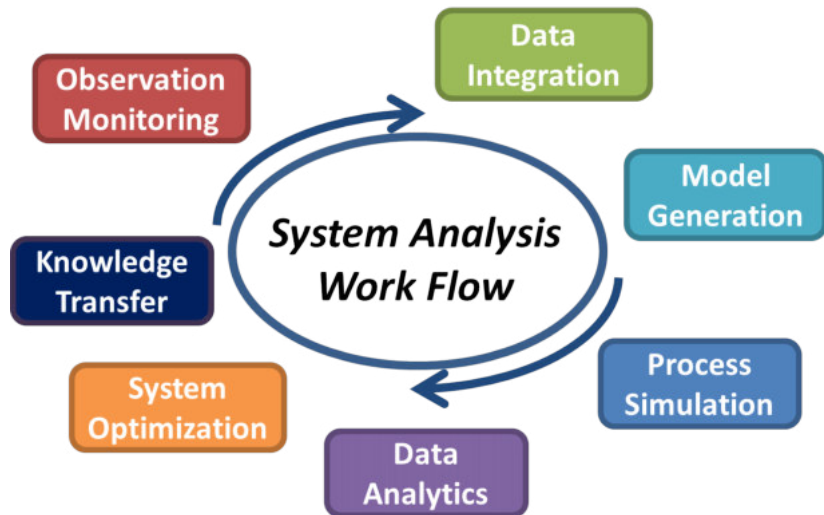
# Umweltinformatik

- Workflows
  - Visualisierung
- 

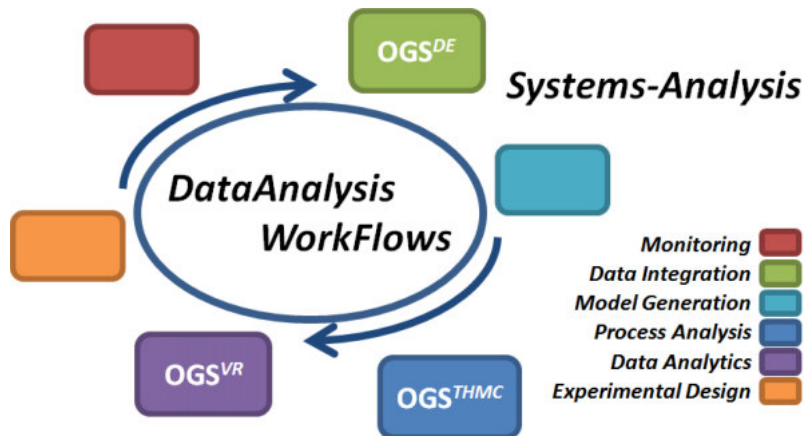
- Big-Data
  - Datenbasierte Methoden (Maschinelles Lernen)
  - ...
- 

- Beispiele (Hydrologie, Geotechnik, Geothermie, ...)

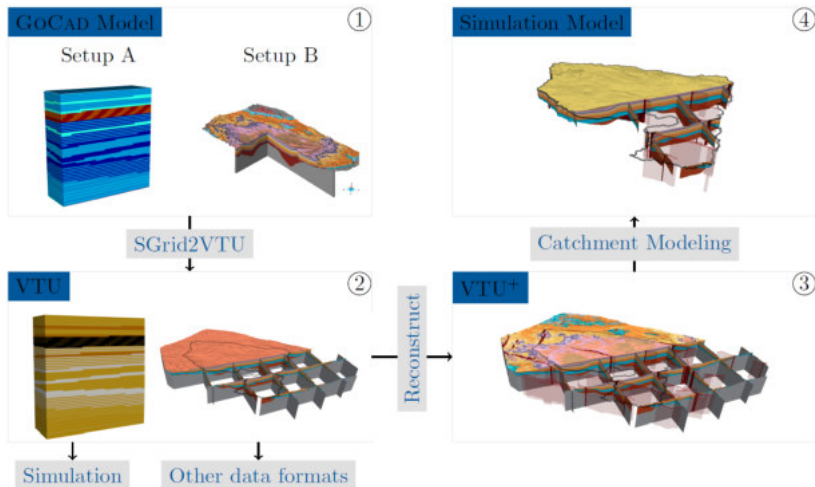
# (Generic) Workflows



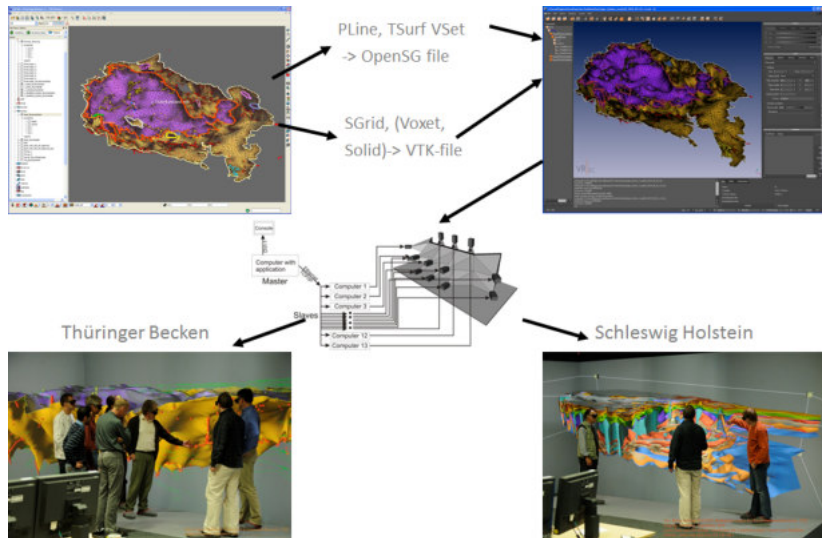
# (Generic) Workflows - Entwicklung



# (Generic) Workflows - Geometrie / Topologie



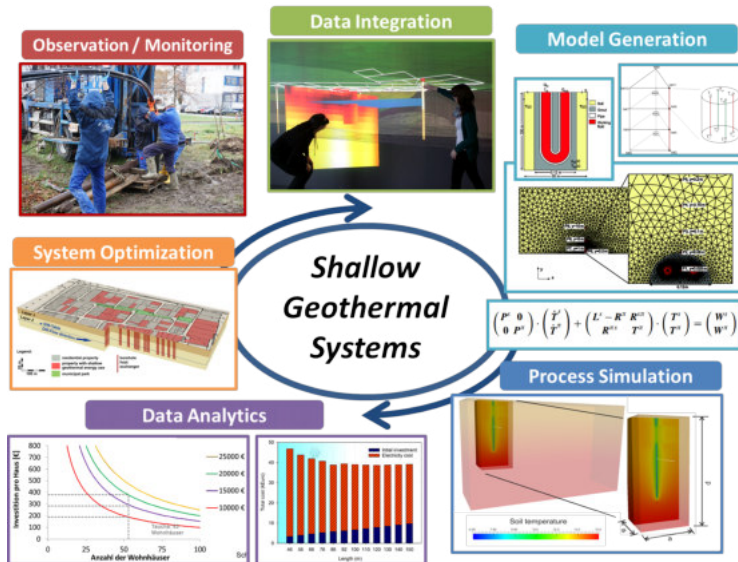
# Wissenschaftliche Visualisierung: VISLAB Exkursion



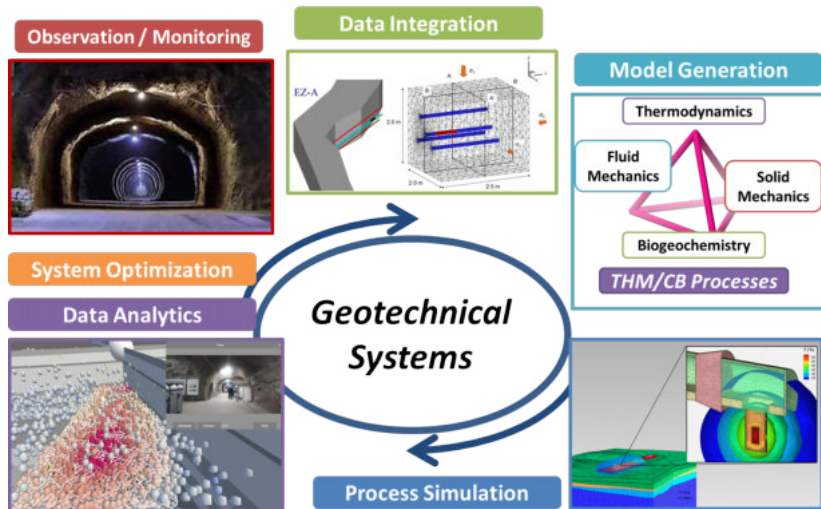
# Workflows (Hydrologie)



# Workflows (Geothermie)



# Workflows (Geotechnik)





# Umweltinformationssysteme: Chaohu

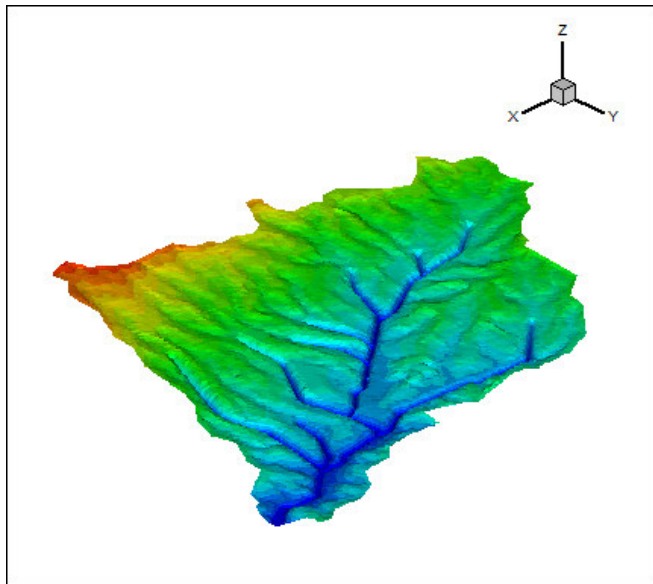
OpenGeoSys



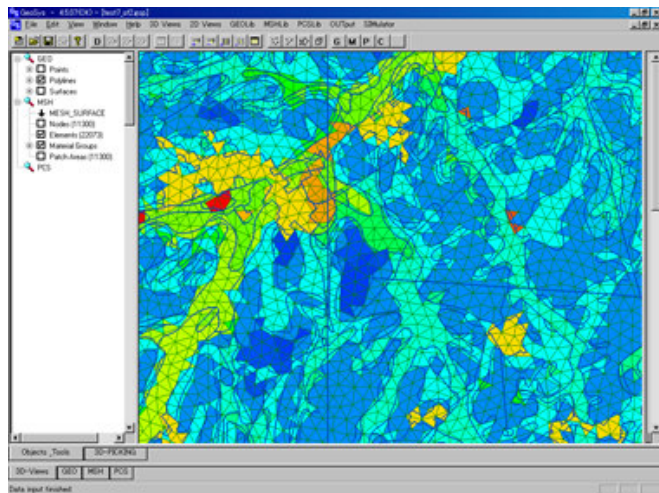
AL.VIS | TIMESERIES

# Beispiele (EIS)

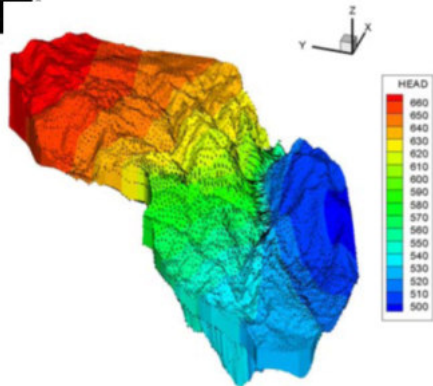
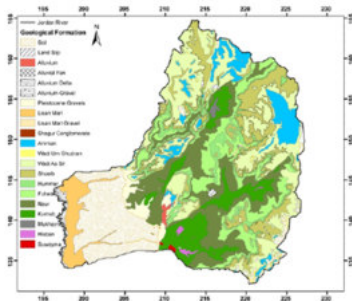
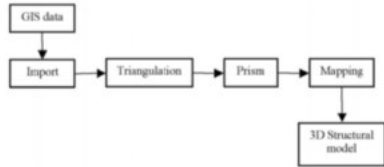
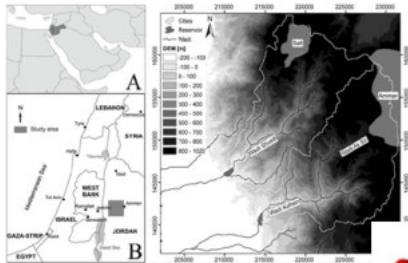
# Catchments



# Catchments

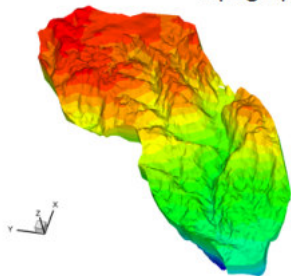


# Catchments: Wadi Kafrein

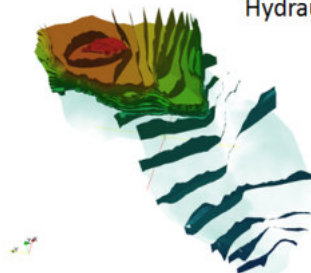


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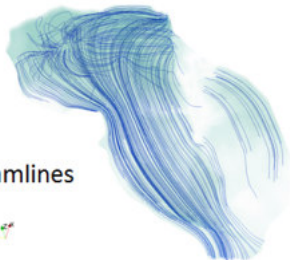
Topography



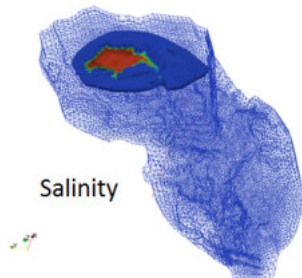
Hydraulic head



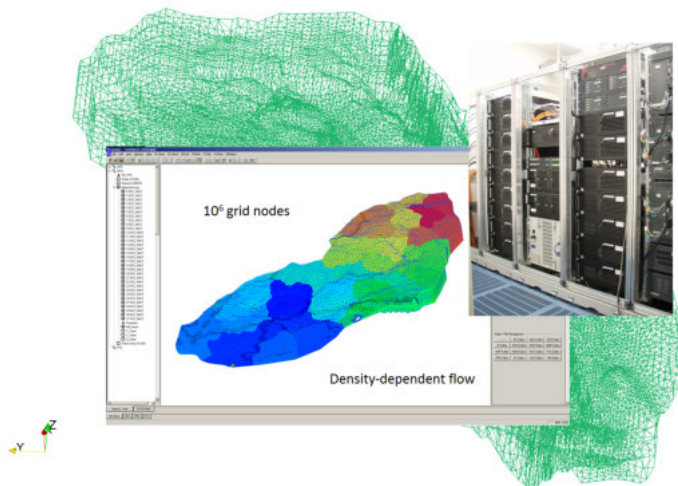
Streamlines



Salinity



# Catchments: Wadi Kafrein

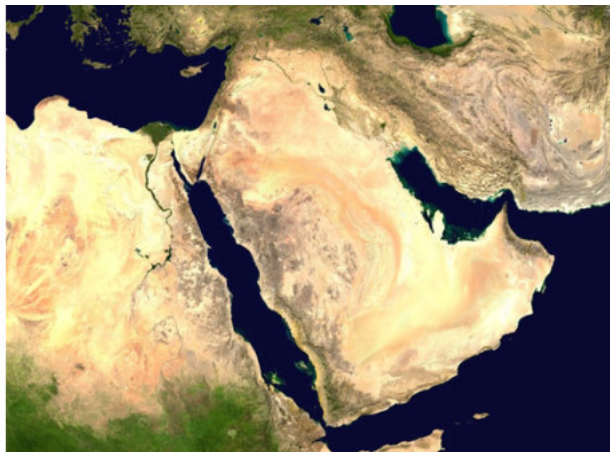


# Mega-Aquifers: Saudi Arabien



Dornier Consulting

gtz





# Mega-Aquifers: Saudi Arabien

Qt

Boundary Boreholes Digital elevation model

OpenGeoSys Data Explorer - 5.0.0600/TF/LE - First floor

File Windows Settings

Stations

Show all stations

Station Name	x	y
Boreholes		
Ubayah 1	46990...	24727...
WA-1807	77114...	22788...
WA-627	88931...	28448...
WUTXD-WW0	11181...	26588...
WUTXD-WW2	11181...	26588...
WW0-A	82875...	21367...
Zaynan	10284...	22837...
4-16-68	44304...	31194...
4-5-100	87927...	27942...
4-5-104	93837...	28486...
4-5-105	98131...	29440...
4-5-108	77526...	23108...
4-5-71	86500...	28722...
4-5-75	88866...	28942...
4-5-80	88024...	30563...
4-5-81	79829...	30648...
4-5-82	78426...	28887...
4-5-86	86043...	26789...
4-5-91	30730...	24934...
4-5-93	88147...	29440...
4-5-99	81790...	28820...
6-2-A	93861...	21521...
7-5-21	96885...	26528...
7-5-50	72405...	26249...

Imported objects (Boreholes)

Visualised Objects

Visualisation Properties

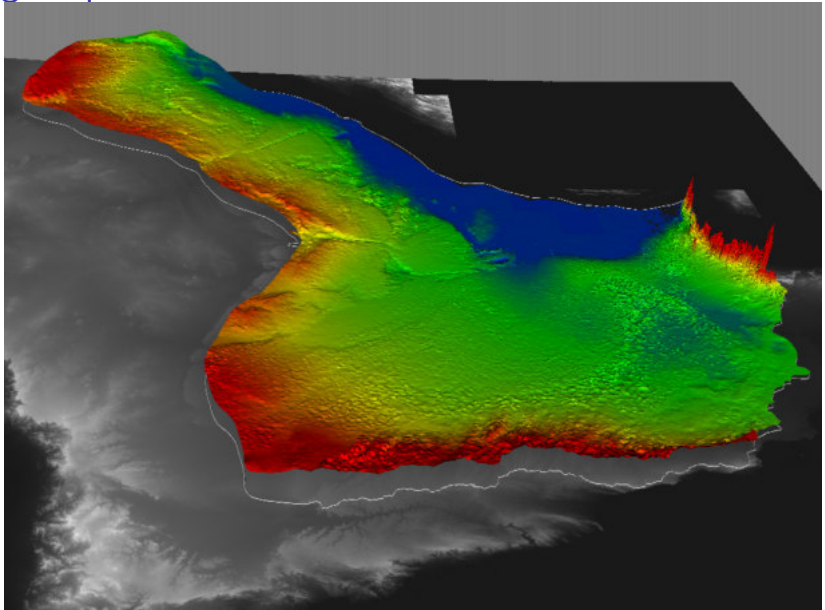
Time series data for hydraulic head

Precipitation event

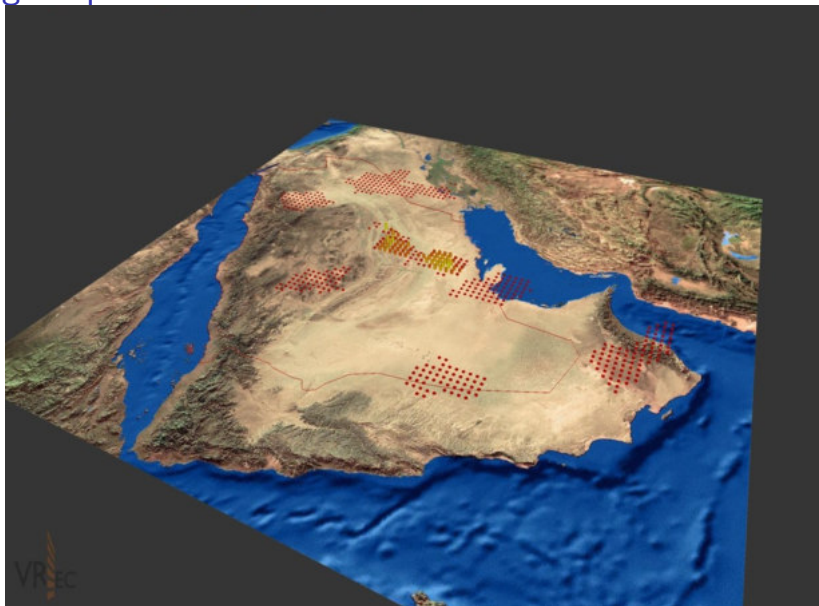
Details for selected Borehole

OpenGeoSys

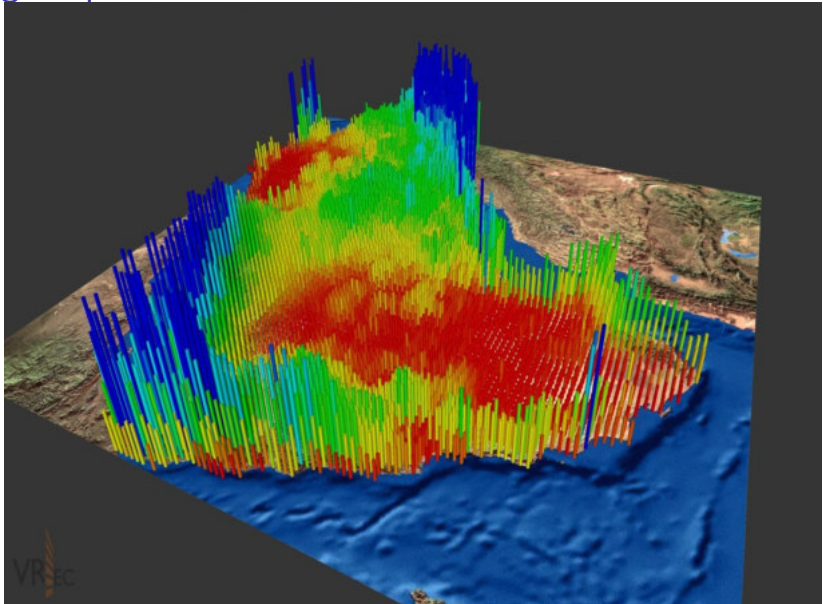
# Mega-Aquifers: Saudi Arabia



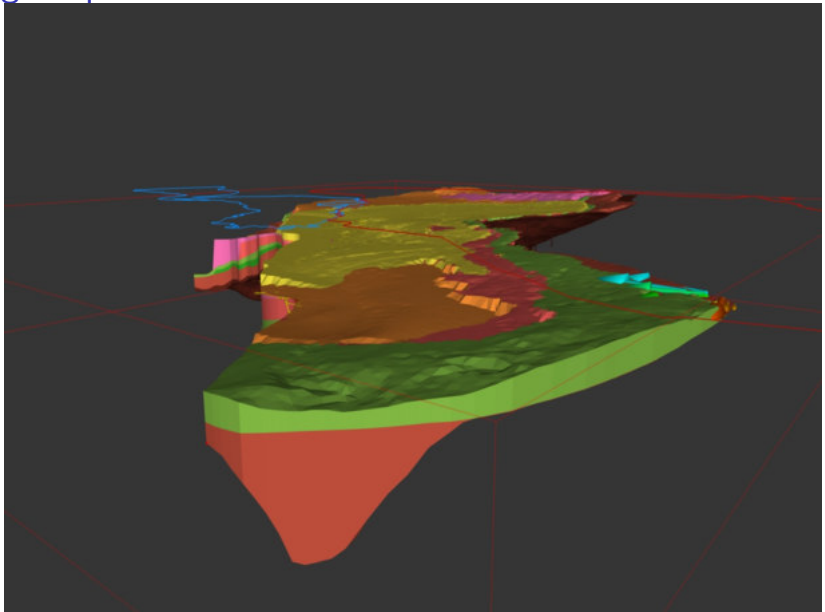
# Mega-Aquifers: Saudi Arabien



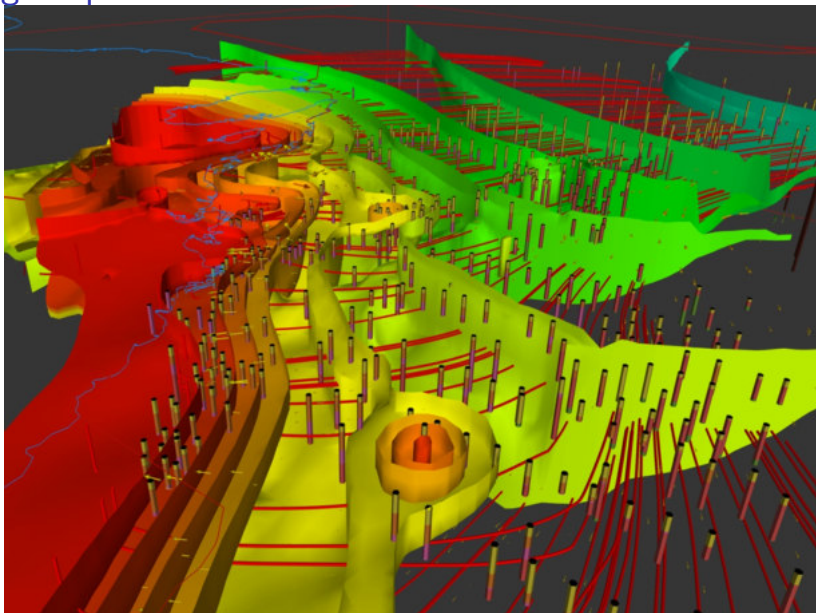
# Mega-Aquifers: Saudi Arabia



# Mega-Aquifers: Saudi Arabien



# Mega-Aquifers: Saudi Arabien



# Hydrologische Systemanalyse

## Methoden

### Hydroinformatik (Lehrinhalte)

1. Grundlagen der objekt-orientierten Programmierung (C++)
2. Grundlagen der hydrologischen Modellierung
  - ▶ GIS (Catchment-Analysen ...)
  - ▶ Netzwerk-Modelle (ANN, Bayessche Netze)
  - ▶ Konzeptionelle Modelle (HRU ...)
  - ▶ Numerische Methoden (prozess-basierte, Mehrfeldproblemen ...)